INTERVERTEBRAL DEVICE AND METHODS OF USE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 61/389,862, filed Oct. 5, 2010, which is incorporated herein by reference.

RELATED APPLICATION

This application is related to U.S. patent application Ser. No. 13/248,747, filed Sep. 29, 2011, titled Minimally Invasive Intervertebral Systems and Methods, which is incorporated herein by reference.

FIELD

The present invention relates generally to a device for treating intervertebral injuries and, more specifically relates to a minimally invasive intervertebral implant.

BACKGROUND

Vertebrae are the individual irregular bones that make up the spinal column (aka ischis) a flexuous and flexible column. There are normally thirty-three vertebrae in humans, including the five that are fused to form the sacrum (the others are separated by intervertebral discs) and the four coccygeal bones which form the tailbone. The upper three regions comprise the remaining 24, and are grouped under the names cervical (7 vertebrae), thoracic (12 vertebrae) and lumbar (5 vertebrae), according to the regions they occupy. This number is sometimes increased by an additional vertebra in one region, or it may be diminished in one region, the deficiency often being supplied by an additional vertebra in another. The number of cervical vertebrae is, however, very rarely increased or diminished.

A typical vertebra consists of two essential parts: an anterior (front) segment, which is the vertebral body; and a posterior part—the vertebral (neural) arch—which encloses the vertebral foramen. The vertebral arch is formed by a pair of pedicles and a pair of laminae, and supports seven processes, four articular, two transverse, and one spinous, the latter also being known as the neural spine.

When the vertebrae are articulated with each other, the bodies form a strong pillar for the support of the head and trunk, and the vertebral foramina constitute a canal for the protection of the medulla spinalis (spinal cord), while between every pair of vertebrae are two apertures, the intervertebral foramina, one on either side, for the transmission of the spinal nerves and vessels.

Conventional spinal spacer assemblies are used in spinal fusion procedures to repair damaged or incorrectly articulating vertebrae. Spinal fusion employs the use of spacer assemblies having a hollow mesh spacer tube and end caps that space apart and fuse together adjacent vertebrae. These mesh spacer tubes are often formed of titanium and are available in varying shapes and sizes. In addition, they can be trimmed on site by the surgeon to provide a better individual fit for each patient. Conventional spinal spacer assemblies come in different cross sections. These spacer assemblies are generally hollow and include openings in the side thereof to provide access for bone to grow and fuse within the mesh tube. The current intervertebral or interbody devices are designed using 3 major principles; the anatomical limitations of the surgical

approach, optimization of bone graft volume to promote bony fusion, and optimization of the device contact with the vertebral endplates to resist subsidence. The current devices are generally static in that they cannot change shape or volume, thus they are limited by the anatomy and technique, and therefore they do not provide optimal bone graft volume or surface contact. The present invention attempts to solve these problems as well as others.

SUMMARY OF THE INVENTION

Provided herein are systems, methods and apparatuses for an intervertebral device. The intervertebral device generally comprises a plurality of struts, wherein each adjacent strut is rotatably associated with each adjacent strut to form a modifiable inner volume V for bone graft containment when the intervertebral device is in an expanded state, and whereby the inner volume V is enclosed by the plurality of struts.

The method of using an intervertebral device generally comprising the steps of: preparing an intervertebral disc space by removing a portion of the annulus, evacuating the nucleus, and then removing the cartilaginous endplates; rotating the intervertebral device about its transverse axis and placing the intervertebral device into the intervertebral disc space with the width TT of the intervertebral device parallel to the vertebral endplates; rotating the intervertebral device 90 degrees about its transverse axis to increase the height of the intervertebral disc space; expanding the intervertebral device to increase the inner volume V enclosed within the plurality of struts, such that the intervertebral device is opened; and filling the inner volume V with bone graft material to permit bone fusion between adjacent vertebrae.

The methods, systems, and apparatuses are set forth in part in the description which follows, and in part will be obvious from the description, or can be learned by practice of the systems, methods, and apparatuses. The advantages of the systems, methods, and apparatuses will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the systems, methods, and apparatuses, as claimed.

BRIEF DESCRIPTION OF THE FIGURES

In the accompanying figures, like elements are identified by like reference numerals among the several preferred embodiments of the present invention.

FIG. **1**A is a perspective view of one embodiment of the intervertebral device in the expanded state; FIG. **1**B is a side view of one embodiment of the intervertebral device taken along lines **1**B-**1**B as shown in FIG. **1**A; and FIG. **1**C is a perspective view of one embodiment of the intervertebral device in the closed state or with a substantially zero inner volume V.

FIG. **2**A is a perspective view of one embodiment of the strut; FIG. **2**B is a top view of one embodiment of the strut taken along lines **2**B-**2**B as shown in FIG. **2**A; FIG. **2**C is a perspective view of an alternative embodiment of the strut; and FIG. **2**D is a perspective view of an alternative embodiment of the strut.

FIG. **3** is a perspective view of one embodiment of adjacent struts and angle A between rotatably associated struts.

FIG. **4**A is perspective view of one embodiment of the intervertebral device in the closed state or with a substantially zero inner volume V; FIG. **4**B is a top view of the interverte-